

XXXV. *Characters and Description of LYELLIA, a new Genus of Mosses, with Observations on the Section of the Order to which it belongs; and some Remarks on LEPTOSTOMUM and BUXBAUMIA.*
By Robert Brown, Esq. F.R.S. Libr. L.S.

Read April 6, 1819.

IN the tenth volume of the Society's Transactions, I have given a description of *Dawsonia*, a genus of Mosses having entirely the habit of *Polytrichum*, but whose peristomium, instead of consisting of a single row of short teeth connected by a horizontal membrane, is composed of an indefinite number of capillary cilia. These cilia, originating both from the inner surface of the capsule, immediately within the orifice, and from the columella itself, form a loose pencil, of which the hairs are sufficiently distinct to allow of a gradual discharge of the seeds.

The correctness of this account of *Dawsonia*, especially as to the origin of the peristomium*, and the nature of the supposed columella†, has been questioned by some of those authors, who have since adopted the genus.

From a careful re-examination, however, I find no reason to alter in any respect the generic character formerly given; and to the description of the species I have only to add, that the upper surface of the leaves is furnished with parallel lamellæ, like those of *Polytrichum*; and that the inner membrane of the capsule is,

* *Bridel Meth. Nov. Muscor.* p. 205.

† *De la Pylaie in Journal de Botanique appliq.* iii. p. 134.

in the early stage at least, connected by numerous plicæ with those elevations of the surface of the columella, which are noticed in my description, and well expressed in Mr. Bauer's excellent figure.

My principal object, in the present paper is to establish another genus of the same family, equally related to *Polytrichum* in habit, which resembles *Dawsonia* in the remarkable form of its capsule, but whose peristomium is of so peculiar a structure as to require its separation from both these, and readily to distinguish it from all other genera of Mosses.

This new genus I shall name *Lyellia*, in honour of Mr. Charles Lyell, an accurate English Botanist, who has particularly studied, and made several important discoveries in, the natural order to which it belongs.

Mr. Hooker has already intimated his intention of establishing a *Lyellia* in the same order, to consist of those species of *Leucodon* that have a mitriform calyptra*; but he has readily agreed to transfer the name of our friend from a genus, respecting which there is still some uncertainty, to one so unquestionable as that here proposed; and as I have not a drawing prepared to accompany the present communication, I trust he will give the necessary illustration of this interesting genus, in an early number of his excellent *Musci Exotici*.

LYELLIA.

Stoma edentulum, clausum *epiphragmate* (crasso depresso), cujus *discus circularis* a limbo (latiori) persistenti sccedens, cum columellâ remanenti inclusâ cohæret.

Capsula hinc plana inde convexa.

Calyptra cucullata (apice pilosa).

* *Musci Exotici*, vol. i. 17.

Muscus (Nepalensis) habitu Polytrichii ; capsulæ figurâ et structurâ interiori Dawsoniæ similis ; peristomio ab utroque genere diversissimus.

LYELLIA CRISPA.

DESCRIPTIO. *Muscus* cæspitosus.

Caulis erectus, simplicissimus, 3-4-uncialis, ipsa basi tomento radicalicinereo copioso tenuissimo tectus, dein, ad $\frac{1}{3}$ circiter longitudinis, basibus emarcidis foliorum squamatus, supra dense foliatus.

Folia undique versa, e basibus dilatatis subcuneatis semivaginantibus membranaceis pallidis imbricatis, subulata, canaliculata, nigro-viridia, opaca ; marginibus ab apice ad $\frac{2}{3}$ longitudinis et ipso apice carinæ serratis ; disco intus longitudinaliter lamellis numerosis, parallelo-approximatis, tenuissimis, e nervo ipsaque superficie ortis ; limbo elamelato minutissime areolato ; madore patula leviterque introrsum falcata, siccitate contorta.

Masculi Flores non visi.

Fructificatio Feminea terminalis, solitaria.

Vaginula cylindræa, villis implexis instructa, apice truncato simplici.

Seta sesquiuncialis—biuncialis, erecta, teres, lævis, castanea, demum cava.

Calyptra (nonnullæ delapsæ solum a nobis visæ) cucullata, hinc altè fissa inde truncata, lævis, apice pilis brevibus simplicibus hispidula.

Capsula erectiuscula, circumscriptione ovata, fusca, vix manifeste areolata, hinc plana et ala perangusta cincta, inde convexiuscula, collo brevissimo cylindræo. *Apophysis* nulla nisi *basis* castaneo-fusca et undique instructa punctis parvis, sparsis numerosis, pustuliformibus, verticaliter ellipticis

lipticis, margine paulo incrassatis, disco angusto, porum referente sed laminam tantum exteriorem perforante.

Operculum (unicum tantum visum quod calyptra delapsa inclusum) e basi depresso-conica desinens in rostrum longitudine circiter ipsius baseos, intus auctum processu cylindraceo, centro baseos inserto, et proculdubio disco circulari terminali columellæ applicito.

Peristomium horizontale, nec obliquum, clausum quasi operculo interiori seu *epiphragmate* crasso, opaco, edentulo, planiusculo, persistente; limbo latiusculo crassiore castaneo; disco pallido leviter depresso; ipso centro circulari plano, crassiusculo fusco, a disco pallido mox separante, arcte cum columella cohærenti, eaque demum abbreviata intra cavitatem retracto.

Membrana interior (s. *Theca vera*) approximata exteriori, quacum processibus numerosis vasculiformibus connexa, ore coarctato, spongioso-membranaceo, collum breve columellæ arcte amplexante, superficie interiore altè corrugata.

Columella in capsula matura majuscula, subovalis, lacunosa, rugis elevatis applicitis et fersan connexis plicis respondentibus membranæ interioris.

Semina minutissima, in cumulo viridia, separatim hyalina, lævia.

Lyellia crispa was lately discovered in Nepaul (probably in the vicinity of Kathmandu,) by the botanical collectors sent from the Company's garden at Calcutta, by Dr. Nathaniel Wallich, the worthy successor of Dr. Roxburgh in that establishment.

The specimens here described were received from Dr. Wallich by Sir Joseph Banks; and I have also seen others sent at the same time to Mr. Lambert, part of which he very liberally communicated.

The whole number of capsules examined does not exceed twenty-five; but as all of these were ripe and of uniform appearance and structure, they will probably be considered sufficient for the establishment of the genus.

To complete the description of *Lyellia*, male flowers, which, however, probably resemble those of *Polytrichum* and *Dawsonia*, are still wanting; and although there is no reason to doubt that the calyptra and operculum, both of which I have ventured to describe from fallen specimens, really belong to this species, yet it would be more satisfactory to find them while still attached to the capsule; for in this state only, the form of the operculum and its probable central connection with the orbicular disk of the peristomium can be absolutely determined. It will be necessary also to examine a greater number of specimens, and perhaps in different states, to ascertain absolutely the œconomy of this moss in the dispersion of its seeds. It is evident, however, if the description already given be correct, that as far as dispersion takes place, by the mouth of the capsule, it can only be effected by a contraction or shortening of the columella, and a corresponding retraction within the cavity of the capsule, of the central portion of the peristomium which adheres to it; and in this state several of the specimens were actually found.

But it is also manifest, both from the great size of the columella, and its numerous points of connection with the inner membrane, that in this way the whole of the seeds cannot be discharged. It is possible therefore, that in certain circumstances at least, their dispersion may be assisted by the minute pores existing at the base of the capsule. These pores, in the specimens examined, were found to penetrate the outer membrane, or even its external layer only, and being situated below the origin of the seminal bag, their first effect will probably be to accelerate the decay of the internal
spongy

spongy texture of the base of the capsule. But by thus removing support from the columella and inner membrane, they may contribute to the greater shortening of the former, and consequently in increasing the dispersion by the mouth of the capsule; or, from the same cause, the inner membrane being at length ruptured, the seeds may be in part discharged by the pores themselves.

It seems then not improbable, from what we at present know of the structure of *Lyellia*, that for the dispersion of the seeds in this genus there are two distinct contrivances, both of which, however, in the only species yet known, are apparently imperfect. But hence it is perhaps allowable to conjecture, that either other species of *Lyellia*, or a nearly-related genus may exist, in which while the mouth of the capsule remains absolutely shut, the pores of the base may be sufficiently enlarged for the complete performance of this important function.

Pores exactly resembling those of *Lyellia crispera* have not hitherto been found in any other moss. I have observed, however, in several specimens of *Polytrichum alpinum* still more minute pustules, not very different in appearance, and similarly situated on the base of the capsule.

In establishing this new genus of Mosses, it is of importance to determine its more intimate affinities in the family to which it belongs. Its place is unquestionably between *Polytrichum* and *Dawsonia*; and it will I believe be admitted, that these three genera, in the natural method, cannot be separated; though they will necessarily form or be referable to distinct sections of an artificial system founded chiefly on modifications of the peristomium.

In attempting to discover characters by which this group of POLYTRICHOÏDEÆ may be distinguished from other Mosses, it is in the first place necessary to determine the whole structure of *Polytrichum*; for this genus, though one of the most common of

the order, and, from the great size of the capsules in many of its species, most readily admitting of accurate observation, has never yet been thoroughly examined.

One of the most striking characters of *Polytrichum* is the dense texture and consequent opacity of the leaves; in which it agrees with the other two genera of the section. This character, however, is not altogether confined to *Polytrichoidæ*, and is wanting in *Polytrichum undulatum* and *angustum*. But the lamellæ of the upper surface of the leaves probably exist, though in very different degrees, in all the species of *Polytrichum*; are equally observable in *Lyellia* and *Dawsonia*; and I am not aware that they have been found in any other genera of the order.

These lamellæ, which are represented in several of the species figured in *English Botany*, by Wahlenberg in *P. levigatum**, and since noticed by Messrs. Hooker and Taylor† as existing in nearly the whole of the genus, do not belong to the nerve only, as the authors of *Muscologia Britannica* seem to suppose, but in several species cover the greater part of the surface of the upper or spreading portion of the leaf; the sheathing base being either entirely destitute of them, or having them much less developed and strictly confined to the nerve.

In the form and position of the male flowers there is probably an absolute uniformity in the whole of this group: but the only peculiarities consist in the perigonal leaf or bractea being formed chiefly of the sheathing part of the stem-leaf; and in the new shoot proceeding from the centre of the star-like cluster. In *P. undulatum*, however, the former character is by no means obvious, and the latter is not perhaps constant; and both are only presumed to exist in *Lyellia*.

The double calyptra of *Polytrichum*, long considered as the

* *Flora Lapon.* tab. 22.

† *Muscol. Brit.* p. 24.

essential

essential character of the genus, equally exists in *Dawsonia*. But this outer or spurious calyptra, formed of densely matted hairs originating from the vaginula and the apex of the inner cucullate calyptra, is wanting in several species of *Polytrichum*, in some of which, and in *Lyellia*, the true calyptra is furnished with a few hairs only, either scattered over the whole of its surface, or confined to its apex; while in others, as in *Polytrichum undulatum*, it is nearly, and in *P. magellanicum* and *lævigatum*, entirely smooth.

Respecting the teeth of the peristomium of *Polytrichum*, I have very little to add, except that in *P. magellanicum* they appear to be eighty in number, which is a higher multiple of sixteen than has hitherto been noticed in this genus, and the greatest number that has yet been found in a single series in the order.

On the nature of the transverse membrane or tympanum of *Polytrichum*, I have formerly made some remarks in treating of *Dawsonia*, and have there considered it as the remains of the pulpy continuation of the columella, originally occupying the cavity of the operculum. But its uniform texture, as well as its exactly circular form and equal margin remain to be accounted for; unless this regularity may be supposed to depend on the circular, and apparently corresponding, aperture of the inner membrane.

Most authors have described the tympanum of *Polytrichum* as minutely perforated. These pores I have never been able to detect; but I observe in many cases an appearance which may perhaps account for the belief in their existence, namely, a minute reticulation on the outer surface of the membrane, apparently owing to the corresponding areolæ of the inner surface of the operculum, with which it was originally in contact.

Polytrichum is remarkable for the various forms of its capsule. Those species, indeed, in which it is quadrangular have been considered

considered as a distinct genus by Mons. de Beauvois. But unless this difference of external form should be found connected with others, either in the habit or in the internal structure, which I believe is not the case, it seems hardly sufficient to justify the subdivision of so natural a genus.

The symmetrical quadrangular capsule, admitting of a regular cylindrical inner membrane, is a character of inferior importance to the plano-convex or dimidiate capsule, which almost necessarily implies, and in *Dawsonia* and *Lyellia* at least is found to be connected with, a corresponding irregularity in the figure of the cavity; and hence I have introduced this remarkable form into the characters of both these genera.

On the structure of the inner membrane of the capsule in *Polytrichum* the only observation that I have met with occurs in *English Botany*, where, in the account of *Polytrichum subrotundum* (plate 1624), it is stated that Mr. James D. Sowerby has discovered, in this species as well as in *Polytrichum undulatum*, a real membranaceous peristomium within the teeth, which, according to Sir James Smith, "gives quite a new idea of the generic character."

This inner peristomium, if it may be so termed, which is well represented in the figure referred to, and consists of a horizontal projection of the inner membrane immediately below its apex, will, I believe, be found to exist in all the species of the genus, and in some cases reduces the aperture of the inner capsule to half the size of the outer at the origin of the teeth. It is always, however, quite entire, and, according to my observations, is formed of a doubling of the inner membrane, with a loose cellular or rather spongy substance interposed between the lamellæ.

Besides this transverse annular projection there are in the inner membrane of all the species of *Polytrichum* that I have examined,

P. undu-

P. undulatum alone excepted, four longitudinal equidistant processes, extending from the aperture to the base of the capsule; and in many species projecting so far into its cavity as to come in contact either with the salient angles or sides of the columella, and consequently to subdivide it into a determinate number of cells.

The analogy of these longitudinal processes with the more numerous and irregular plicæ in *Dawsonia* and *Lyellia* is obvious; and I have not myself met with similar processes of the inner membrane in any other genus of mosses. They do not, however, afford an absolutely distinguishing character of this group, as they seem to be altogether wanting in *Polytrichum undulatum*; and Hedwig, it must be admitted, has represented an apparently analogous structure in *Gymnostomum pyriforme**.

The quadrangular or four-winged columella of *Polytrichum commune* is well figured and described by the accurate Schmidel†; and I have found an equally regular form of this body in most of the species of *Polytrichum* that I have examined; though in many it is less evidently winged than in *P. commune* and the species nearly related to it.

Mons. de Beauvois seems to consider the alæ of the columella as themselves forming complete septa, and also that in this state they exist only in such species as have quadrangular capsules; for to these he limits his genus *Polytrichum*, distinguished by him from *Pogonatum* by its multilocular fruit. The cavity, however, is completely subdivided in several of the species with cylindrical capsules, as in *P. urnigerum*, and in a new species very nearly related to it (*P. microstomum*, nob.) lately received from Dr. Wallich: and the alæ of the columella, as far as

* *Fundam. Hist. Nat. Muscor. Frond.* pars ii. tab. 2. β.

† *Icones pl.* p. 236. tab. 59. fig. 15.

I have

I have observed, never form complete septa, at least in the ripe fruit; though in those species having quadrangular capsules they nearly reach the parietes opposite to the external angles, towards which they are directed.

As the columella of *Polytrichum* retains its regular form in the ripe capsule, its real structure may even then be in a great measure determined. In this stage I find its wings, or compressed sides, to consist of a double membrane with an intermediate spongy substance, in which there is no appearance of granules; and the internal denser substance of the axis is equally free from granular matter. But as there is no indication of lateral rupture, the sides in several species remaining perfectly smooth, nor of any central cavity, this structure affords a powerful argument in refutation of those hypotheses which assume the existence of two kinds of granules in the capsules of mosses; the one produced in the cavity formed by the internal membrane, the other in the substance or supposed cavity of the columella itself; the latter being considered as seeds in one of the hypotheses*, and in the other as pollen†.

This argument, however, is not here advanced to disprove the existence of two kinds of granules in the capsules of mosses, but merely against their production in the distinct cavities assigned to them in the hypotheses referred to.

In the greater number of *Polytricha* as well as in *Lyellia* and *Dawsonia* the seeds are extremely minute; a fact with which the increased surface for their production is probably connected: for in *P. undulatum*, where the seeds are larger than in most other species of the genus, this increased surface does not exist; and in *P. lavigatum*, where they are of still greater size, the plicæ of the inner membrane are probably also wanting.

* Palisot Beauvois, *Æthiog.* p. 5.

† Keith, *Physiol. Bot.* ii. p. 346.

Although

Although there is but little resemblance in the structure of the peristomium among the different genera of *Polytrichoïdeæ*, they may still be said essentially to agree in the function of this part: for in all of them the complete separation of the seeds is ensured by the smallness of the apertures for their discharge. It may be remarked, that the necessity for this complete dispersion in Mosses seems to be inversely as the size of the seeds. For in those genera of the order in which the capsule either bursts irregularly or has a naked mouth, the seeds are in general larger than in those with a single, and still more manifestly than in those with a double, peristomium. And in conformity with this also, in *Polytrichum undulatum* and *levigatum* the tympanum is sooner ruptured or removed than in the other species of the genus.

The result of this comparison of *Polytrichum* with *Lyellia* and *Dawsonia*, although it confirms the propriety of their approximation, does not afford any clearly distinguishing mark for the very natural section of the order which these three genera form. In the mean time, however, it may be circumscribed, though not with absolute precision, by a combination of the more general characters which have been now enumerated.

LEPTOSTOMUM.

In defining this genus, which was first proposed in my former paper on Mosses, I relied chiefly on the undivided annular projection of the inner membrane of the capsule. I was induced to employ this modification of the peristomium as a character, though certainly far from being obvious, in finding it to exist in several mosses of the southern hemisphere, having a similar and peculiar habit; and which, had it been neglected, I must have referred to *Gymnostomum*, with the greater number of whose species they have hardly any thing in common.

Mr. Hooker, however, has since found, as he states, the same structure in several other mosses, generally considered as having a naked peristomium, particularly in *Gymnostomum microstomum*, *Griffithianum*, and *fasciculare*; and as these species have but little resemblance to each other, and still less affinity to *Leptostomum*, he has reduced this genus also to *Gymnostomum*.

If the statement referred to be correct, *Leptostomum*, though it may be a natural genus, must be given up, until other marks shall be found by which it may be distinguished. I have not had specimens sufficiently perfect to enable me to judge of the structure of all the species of *Gymnostomum* mentioned by Mr. Hooker. In one of them, however, *Gymnostomum microstomum*, the peristomium is certainly very different from that of *Leptostomum*. In this species I find, on removing the operculum, that the mouth of the capsule is not only completely covered by a horizontal membrane, but that this covering is derived from the outer membrane of the capsule, and consequently differs in origin as well as in form from the peristomium which it has been said to resemble. Its central portion, however, being extremely thin is soon ruptured and deciduous, and in this state only it has been seen by the authors of the *Muscologia Britannica*.

Gymnostomum microstomum therefore may itself be considered as a distinct genus, to which the name of *Hymenostomum** may be given; and it is worthy of remark, that in its technical character it approaches most nearly to *Lyellia*, though no two mosses differ more widely in almost every other respect.

* HYMENOSTOMUM.

Fl. Fem. terminalis.

Stoma edentulum, clausum *epiphragmate* (e membrana exterioro orto), *disco* tenuissimo
(a columella libero) mox rupto et evanido; *limbo* persistenti horizontali indiviso.

Calyptra dimidiata, lævis.

Fl. Mas terminalis, gemmiformis.

From

From the account given of *Gymnostomum Griffithianum* it appears that this species also has in the early stage a membrane completely covering the mouth of the capsule. But this membrane probably differs in origin, at least, from that of *Hymenostomum*, as it seems to do both in form and dehiscence from the peristomium of *Leptostomum*.

Of *Gymnostomum fasciculare* I have examined only imperfect specimens, I cannot therefore speak with confidence of its structure. The annular process, however, mentioned by Mr. Hooker is more likely to be the remains of a complete horizontal covering, and probably originating from the inner membrane, than to resemble the peristomium either of *Hymenostomum* or *Leptostomum*. A membrane of this kind is certainly present in some species of *Gymnostomum*, and perhaps may be found in all those that really belong to that genus. It exists also in *Weissia Templetoni*, which so closely resembles *Gymnostomum fasciculare* as to be with difficulty distinguished from it, unless by the inspection of the peristomium; and, in addition to the erect annular peristomium from which the character of the genus is taken, I have observed a similar membrane in *Leptostomum* itself. It seems even to be not an uncommon process or termination of the inner membrane, though it has been remarked only in some of its more obvious and persistent modifications. Thus the spongy membrane figured and described in the two published species of *Calymperes*, seems to be an analogous structure*, as is also the circular disk terminat-

* The circular spongy membrane covering the mouth of the capsule certainly does not form an essential part of the character of *Calymperes*; for, in the only species that I have examined, it is either entirely wanting, or firmly adheres to the inner surface of the operculum, along with which, also, a considerable portion of the columella separates. Nor has Swartz, who established the genus (in *Spreng. Schrad. und Link Jahrb. der Gewäch.* vol. i. p. 1.) even noticed this membrane in his description.

ing the columella in several species of *Splachnum*; and perhaps even the tympanum of *Polytrichum* may be of similar origin.

But these characters of *Leptostomum* and *Hymenostomum*, though they do not appear to have been yet observed in any other mosses, may still perhaps be considered too minute for generic distinctions: and it must be admitted that were nothing to be obtained but the subdivision of an extensive natural genus it could not be necessary to have recourse to them. The divisions in question, however, are certainly not of that kind.

The weakest part indeed of Hedwig's system is its bringing together all those mosses that have a naked peristomium, and even including the greater part of them in the genus *Gymnostomum*; while many of the species so associated are in real affinity much nearer to several other genera of the order having a simple or even a double peristomium.

Thus *Gymnostomum microstomum*, the *Hymenostomum* of the present paper, has less the habit of the genus in which it is placed than of *Weissia*, to some of whose species, especially *W. affinis* and *trichodes*, it seems to approach even in the structure of its peristomium.

Several species of that section of *Gymnostomum*, to which perhaps the genus should be limited, especially *G. fasciculare*, *Bouplandii*, and *Rottleri*, can hardly be distinguished from *Weissia Templetoni**.

* *Weissia Templetoni*, along with a nearly related species found in New Holland, *Funaria minor* of Delile (*Flor. Ægypt.*), and perhaps also *Weissia radians*, may form a genus distinct from *Weissia*, and nearly related to *Funaria*, differing chiefly in the irregular bursting and evanescence of the inner peristomium, which in *Funaria* is regularly divided and generally persistent, though in some cases perhaps equally deciduous. In a variety of *Weissia Templetoni*, or a very nearly related species, collected in 1800 in the county of Donegal, I have observed the outer peristomium to be not unfrequently wanting, even before the separation of the operculum; a fact which, if hereafter confirmed, would establish its affinity to *Gymnostomum fasciculare*.

Gymnostomum or *Anictangium pulvinatum* agrees in every other part of its structure with *Grimmia*.

Gymnostomum lapponicum, notwithstanding the difference of calyptra, may be considered as related to *Grimmia Daviesii*, and consequently to *Orthotrichum*, which *G. Daviesii** resembles in its teeth being approximated in pairs.

Gymnostomum viridissimum has exactly the habit and calyptra of *Zygodon*.

Gymnostomum pennatum (*Schistostega* of Mohr,) in one remarkable character may be compared with *Fissidens*†.

Anictangium aquaticum is evidently related to *Cinclidotus* or *Trichostomum*.

Gymnostomum julaceum and *Hedwigia secunda* of Hooker resemble certain species of *Pterygynandrum*, *Neckera* and *Leskia*.

An unpublished moss (*Glyphocarpa capensis*) with a naked peristomium, which I observed on the Table Mountain of the Cape

* *Griffithia Daviesii* nob.

† As Schkuhr (in *Krypt. Gewäch.* ii. p. 31. t. 12.) has ascertained that the operculum of *Gymnostomum pennatum* separates entire, the genus *Schistostega* must be again reduced to *Gymnostomum*, until other distinguishing characters are discovered.

Its resemblance to *Fissidens* consists in the somewhat similar disposition of leaves.

In *Fissidens*, as limited by Bridel, (*Muscol. Nov.* p. 186) the leaves are universally described as presenting their margin instead of their disk to the stem, and as having a doubling of the lower half of their inner or upper margin, extending as far as the nerve.

On this view Bridel (in *l. cit.*) has formed a separate section of the order, consisting of *Fissidens* and *Octodiceras*; and hence also M. de la Pylaie has changed the name of *Fissidens* to *Skitophyllum*. (*Journal de Boton. Appliq.* iv. p. 133.) It seems to me a much simpler explanation of the apparent anomaly to consider the supposed doubling or division of the leaf as its true disk, and the deviation from the usual structure as consequently consisting in the greater compression of the leaf, and in the addition of a dorsal and terminal wing. In support of this view it may be observed, that in the lower leaves of the stem both the additional wings are greatly reduced in size, and in some cases entirely wanting, as they universally are in the perigonal leaves, which have likewise the more ordinary form, being moderately concave and not even navicular.

of Good Hope, has the spherical striated capsule as well as the inflorescence and ramification of *Bartramia*: and with this genus also *Anictangium Humboldtii* agrees in its capsule, though its habit is that of *Leskia* or *Hypnum*.

Drepanophyllum of Richard (*Dicranum? falcifolium* of Hooker,) in form and disposition of leaves is related to *Fissidens* and *Neckera*.

Calymperes approaches to *Orthotrichum*, or rather, perhaps, to *Schlotheimia* or *Macromitrium*.

Lyellia, which belongs to the same division of the artificial system, is evidently allied to *Dawsonia* and *Polytrichum*.

And lastly, *Leptostomum*, the genus more particularly under consideration, appears to me most nearly related to *Bryum*; with which indeed its affinity would be completely established, were Hedwig's account of the peristomium of *Bryum macrocarpum* proved to be correct.

To the observations now made on the various affinities of mosses which agree in having a naked peristomium, it may be added, that the genera with a simple peristomium do not form a strictly natural series, several of them being much more nearly related to those in which the peristomium is double than to each other.

But if the correctness of these statements be admitted, it follows that, in many cases to obtain natural genera in this order either additional sources of distinction must be sought for, or those at present in use more minutely investigated.

Of additional characters, which in some cases may be employed with advantage, I shall merely advert to the membranes of the capsule being distinct or contiguous, and to that more intimate union where there seems to be a single membrane only; to the modifications of internal structure of the inner membrane; the differences in form and duration of the columella, or even its being entirely wanting in the ripe capsule; the presence or absence

sence of the annulus; and the insertion, form and relative position of the male flowers, which, though always considered of importance by Hedwig, many of the most distinguished muscologists of the present day entirely exclude from the characters of their genera.

With respect to the principal source of generic distinctions, the Peristomium, in addition to the circumstances generally attended to, namely, the origin, number, direction, form, and actual division of the teeth, it may be of some importance to ascertain their æstivation, which, though very generally, is not always valvular: and especially to mark the existence or want of the *longitudinal striæ* or semi-pellucid lines: for these, if they do not prove the compound nature, at least clearly indicate a tendency to division in the teeth where they are found; division being always in the course of the striæ, and in no instance taking place unless where they are present.

But in considering them, which I am inclined to do, as proving composition or confluence of the teeth, it would appear that there is a much greater uniformity in the structure of the simple or outer peristomium, at least, than is generally admitted; and that the prevailing number of teeth in this series is thirty-two; though by a coalescence, more or less complete, they are frequently reduced to sixteen, in some cases to eight, and in a few even to four.

According to this view, a single longitudinal line in the axis of a tooth indicates the confluence of two teeth; three equidistant lines, one being central, the coalescence of four; and seven lines similarly disposed that of eight.

Nearly the whole of these modifications exist in that natural subdivision of the order, which may be named *Splachneæ*, consisting of *Splachnum*, *Systylum*, *Tayloria*, (*Hookeria* of Schwaegrichen,) *Splachnum squarrosum* of Hooker, and *Weissia splachnoides*.

The

The number of teeth in SPLACHNEÆ is thirty-two, which, however, are never entirely distinct and at the same time equidistant, but approximated or united in various degrees in the different genera and species of the section.

Thus in *Tayloria* and *Systylium* the thirty-two teeth are distinct and disposed in sixteen pairs.

In *Splachnum rubrum* and *luteum* there are apparently only eight pairs, each tooth, however, having a pellucid and obscurely-perforated axis. In almost all the other genuine species of *Splachnum* there is the same disposition as in *S. rubrum* and *luteum*; but the pellucid axis of each tooth is less distinct and imperforated.

In *Splachnum angustatum*, and I believe also in a second species nearly related to it, the arrangement is somewhat different; for the sixteen apparent teeth are approximated, and at the base even united in fours, the pellucid axis of each tooth being still less obvious. Hence these species in their peristomium very nearly approach to *Tetraphis*, to which they would be absolutely referable were the union complete.

In *Splachnum squarrosum* the apparent number of teeth is eight, without any actual subdivision. But as each tooth has three equidistant pellucid lines, of which the lateral are nearly as distinct as the central, there can be no doubt that the composition is the same here as in the rest of the section*.

By

* In a late number of *Musci Exotici*, (No. 17. tab. 136.) *Splachnum squarrosum* is transferred to *Octoblepharum*, and, on the authority of M. de Beauvois, is stated to be *Octoblepharum serratum* of Bridel. Mr. Hooker, however, continues to refer it to this genus, on the supposition of its agreeing with the original species in the form of its calyptra: observing that if this should prove not to be the case, it ought to be separated, under the generic name *Orthodon*, formerly given to it by its discoverer M. Bory de St. Vincent.

The calyptra of *O. allidum* is represented as distinctly cucullate, both by Swartz (in *Obs. Bot.* tab. xi. fig. 1.) and M. de Beauvois (in *Flore d'Oware*, i. tab. 31.). I have also
observed

By these lines also *S. squarrosus* is readily distinguished from *Octoblepharum*, in which the apparent number of teeth is the same: for in *Octoblepharum* each tooth has only a single pellucid line; and hence its affinity to certain species at present referable to *Weissia*, with a nearly similar habit and sixteen distinct teeth, whose axis is not perceptibly pellucid.

Weissia splachnoides differs from the other *Splachneæ* in having sixteen equidistant teeth; but as these teeth, according to the indication of the pellucid axis, are double, the arrangement may be compared with that of *Tayloria* and *Systylium*, in which the separation into thirty-two is complete, and the sixteen pairs equidistant. It agrees, however, also in this respect with *Grimmia* and with several species of *Weissia*: but in other important characters, as well as in habit, it is evidently related to *Splachnum*, and offers perhaps one of the best examples of the importance of the male flowers in distinguishing natural genera.

Even *Tetraphis pellucida* may be cited in proof of the same prevailing number in the peristomium; each of its four teeth, when highly magnified, appearing to have seven longitudinal striæ, which, according to this test, would make the real number thirty-two; a structure contributing to fix the place of *Tetraphis* in the natural series between *Splachnum* and *Orthotrichum*.

observed it of the same form in specimens from Madagascar. There seems, therefore, no reason to doubt that these two mosses differ materially even in this part of their structure; and as other differences, of at least equal importance, also exist, both in the peristomium and male flowers, *Octoblepharum serratum*, whose habit is nearly that of *Splachnum*, may be distinguished both from that genus and from *Octoblepharum* by the following characters.

ORTHODON.

Fl. Fem. terminalis.

Peristomium simplex, octodentatum, dente singulo striis tribus longitudinalibus instructo (ideoque e quatuor coalitis composito).

Calyptra mitriformis (4-fida, pilosa).

Fl. Mas terminalis, discoideus.

Better evidence on the same subject is afforded by *Trichostomum*, *Didymodon*, and *Leucodon*, in all of which the thirty-two teeth are distinct, though approximated in pairs; by the sixteen bifid teeth of *Dicranum* and *Fissidens*; and by the like number of teeth with a perforated axis in *Trematodon*, *Weissia nuda*, *Didymodon latifolium*, and several species of *Grimmia*.

In all the genera having a double peristomium I believe the pellucid axis more or less manifestly exists; but in these genera there is a great uniformity in the apparent number of teeth in the outer peristomium; there being no instance of actual division in this series beyond sixteen, or of a further approximation, unless in *Orthotrichum*, in several of whose species the approximation or even union of the double teeth by pairs takes place, while in a few others the sixteen teeth are slightly divided at the apex, and in the whole genus the pellucid axis is remarkably distinct.

The only exceptions to the actual division into thirty-two, or the structure indicating that number, in the simple peristomium of mosses, occur on the one hand in certain species of *Weissia*, perhaps in *Encalypta* and in *Octoblepharum*, in all of which, I believe, there is a reduction to sixteen: and on the other in *Polytrichum*, where the number is frequently increased, varying in the different species, and chiefly by multiples of sixteen, from thirty-two to eighty. In this genus also, whatever the number may be, the teeth never have a semipellucid, but rather an opaque or thickened axis, and no tendency to union or even approximation is observable. The constant equidistance of the teeth in *Polytrichum* seems to be connected with its peculiar mode of dissemination; for as this takes place through the interstices of the teeth, and as complete separation of the seeds seems necessary on account of their extreme minuteness, a reduction in number and consequent increase of size of these apertures would probably,

bly, in some degree, prevent dispersion, while the unequal distances of the teeth might either produce a deviation from the regular figure, or an early rupture, of the tympanum, which forms an essential part in this economy.

BUXBAUMIA.

In my former paper I have proposed to preserve the genus *Buxbaumia*, as established by Schmidel; and in constructing a character to comprehend both species, I entirely rejected the outer peristomium of Hedwig; and having also adopted his opinion respecting the middle peristomium of *B. aphylla*, which he has termed corona, and considered as analogous to the annulus in many other mosses, it became unnecessary to advert to this part in defining the genus.

Mr. Hooker has since published an excellent analysis of both species, and has followed Ehrhart and Mohr in regarding them as forming distinct genera.

This determination I have now no hesitation in adopting; for, whatever the nature of Hedwig's corona may be, it affords at least an obvious character, and is connected with other differences of sufficient importance to justify the separation; though the two genera must always remain in the same natural section of the order.

The observations that follow belong, therefore, solely to *Buxbaumia aphylla*.

My first remark on this plant relates to its peristomium, on the nature of which, as compared with that of other mosses; at least two different opinions may be formed.

According to one of these, the outer peristomium of Hooker may with Hedwig be considered analogous to the fimbria or annulus existing in many other mosses; and the principal objection

to this view would perhaps be obviated by rejecting the outer peristomium of Hedwig, as I have formerly proposed, and which Mr. Hooker has since done; as there would then be nothing either in the origin or texture of this part essentially at variance with the supposition; the principal remaining difference being its greater length; for the cilia of the peristomium of *Buxbaumia* may be compared with the striæ or divisions existing in the annulus, which seem to be equally determinate in number, and in some cases also disposed in a double series.

On the second supposition, the peristomium of *Buxbaumia* originating entirely from the outer membrane, may, though consisting of several and even of dissimilar series, be regarded as analogous to that portion of the pencil of *Dawsonia* which arises from the same part of the capsule. This analogy is suggested by Mr. Hooker, and is confirmed by a circumstance that he does not seem to have noticed, namely, that his outer peristomium, the corona of Hedwig, consists of a double series of cilia. The number of cilia in each series exceeds sixteen, but hardly amounts to thirty-two; it probably, however, corresponds with that of the plicæ in the membranaceous peristomium.

We have here then a passage from a number still perhaps definite, though disposed in a triple series, to the indefinite number peculiar to, and so striking in, *Dawsonia*.

My second observation relates to the inner membrane of the capsule, of which I find the mouth to be quite entire and open, though before the separation of the operculum it is closed by the terminating process of the columella. Hence *Buxbaumia* has some resemblance to *Polytrichum*, and a still greater to *Lyellia*, in this part of its structure.

Buxbaumia aphylla is the only moss considered as being entirely destitute of leaves; and though it has been oftener and more fully described

described than any other plant of the order, from the monographs of Linnæus and Schmidel to the excellent illustration recently published by Mr. Hooker, there is no difference of opinion on this point. I have lately ascertained, however, that *Buxbaumia aphylla* is always furnished with perfect leaves, which more nearly resemble, both in texture and division, those of a *Jungermannia* than of any species of moss properly so called; and consequently are widely different from those of *Polytrichoidææ*, to which this genus is in several respects related.

The leaves in the barren plant, where I first observed them, are lanceolate and but slightly divided. Those at the base of the female perichætium are even broader than the former, but more deeply cut, both laterally and at top, into several capillary segments; while the leaves which proceed from the surface of the perichætium are still more deeply divided, and their segments so much elongated that the minute foliaceous base has been universally overlooked, and the perichætium consequently described as covered with hairs.